AMENDMENTS TO THE CLAIMS

This listing of claims will replace all prior versions and listings of claims in the application.

Listing of Claims:

1. (currently amended) A method for processing a digital image, the method comprising:

acquiring a digital image of a biological object;

estimating a foreground region having a first set of pixels from the image relating to ~~an imaged~~ to the biological object;

estimating a background region having a second set of pixels from said image relating to other than the ~~imaged~~ biological object;

by using the image, the estimated foreground region and the estimated background region, calculating a transition region having a third set of pixels disposed between the foreground region and the background region; and,

processing the foreground region, the background region and the transition region separately and independently of each other for suppressing pixel intensities in the estimated background region and improving image quality to generate a filtered image of the biological object.

2. (previously presented) The method of Claim 1, wherein:

the estimating a foreground region comprises defining an initial foreground region as that region containing those pixels of the image meeting a first criterion; and

the estimating a background region comprises defining the background region as that region containing those pixels of the image meeting a second criterion; and,

the transition region is calculated by a gradient constrained hysteresis threshold method.

3. (original) The method of claim 2, wherein the first criterion comprises a pixel intensity greater than a first threshold.

4. (original) The method of claim 2, wherein the second criterion comprises a pixel intensity less than a second threshold.

5. (original) The method of claim 2, wherein the calculating a transition region comprises calculating the transition region as that region containing those pixels of the image meeting a third criterion.

6. (original) The method of Claim 5, wherein the third criterion comprises:

a pixel having a pixel intensity greater than the second threshold, a morphological connection to a foreground pixel, and a gradient magnitude that is within a gradient tolerance value of the gradient magnitude of the foreground pixel.

7. (currently amended) A method for processing a digital image, the method comprising:

acquiring a digital first image of a biological object;

estimating a foreground region from the first image relating to ~~an imaged~~ the biological object, wherein the estimating of a foreground region includes defining an initial foreground region as that region containing those pixels of the first image meeting a first criterion;

estimating a background region from the first image relating to other than the ~~imaged~~ biological object, wherein the estimating a background region includes defining the background region as that region containing those pixels of the first image meeting a second criterion; and

by using the first image, the estimated foreground region and the estimated background region, calculating a transition region disposed between the foreground region and the background region by a gradient constrained hysteresis threshold method, wherein pixels of the transition region meet a third criterion;

wherein the estimated foreground region, the estimated background region, and the calculated transition region, each comprise a separate set of pixels that may each be processed separately for suppressing pixel intensities in the estimated background region and improving image quality; [[and,]]

iteratively calculating incremental transition regions, each having an incrementally larger gradient tolerance value, until a gradient tolerance value threshold is met or exceeded, wherein:

each incremental transition region is calculated to be that region containing pixels connected to a pixel of a previously calculated incremental transition region, having an intensity greater than the second threshold, and having a gradient magnitude that is within the incrementally larger gradient tolerance value of the gradient magnitude of the incremental transition region pixel to which it is connected; and,

generating a second image of the biological object when the gradient tolerance value threshold is met or exceeded.

8. (original) The method of Claim 7, wherein the calculating a transition region further comprises:

using a focus parameter to merge a defined number of the initial plus incremental transition regions into a single transition region.

9. (original) The method of Claim 8, further comprising:

defining an object region as the union of the initial foreground region and the single transition region, and performing at least one morphological operation on the object region.

10. (currently amended) The method of Claim 9, further comprising:

defining a final foreground mask as the initial foreground region;

defining a final transition mask as the difference between the object region and the final foreground region; and

defining a final background mask as the remainder of the first image.

11. (original) The method of Claim 8, further comprising:

suppressing pixel intensities in the background region by gradually reducing the intensity of background pixels to zero as a function of their distance from the object region.

12. (original) The method of Claim 11, wherein the function comprises a linear ramp function, an exponential function, a Gaussian function, a Hanning function, a Hamming function, any function for reducing a value with respect to distance, or any combination of functions comprising at least one of the foregoing functions.

13. (original) The method of Claim 5, further comprising:

defining an object region as the union of the initial foreground region and the initial transition region, and performing at least one morphological operation on the object region.

14. (currently amended) The method of Claim 13, further comprising:

defining a final foreground mask as the initial foreground region;

defining a final transition mask as the difference between the object region and the final foreground region; and

defining a final background mask as the remainder of the first image.

15. (original) The method of Claim 14, further comprising:

suppressing pixel intensities in the background region by gradually reducing the intensity of background pixels to zero as a function of their distance from the object region.

16. (original) The method of Claim 15, wherein the function comprises a linear ramp function, an exponential function, a Gaussian function, a Hanning function, a Hamming function, any function for reducing a value with respect to distance, or any combination of functions comprising at least one of the foregoing functions.

17. (currently amended) The method of Claim 1, wherein the digital image is ~~a digital image of a biological object obtained~~ acquired using MR imaging, CT imaging, Ultrasound imaging, X-ray imaging, or any combination comprising at least one of the foregoing imaging processes.

18. (currently amended) A program storage medium, readable by a computer, ~~tangibly embodying~~ storing a program of instructions executable by the computer to perform a method for processing a digital image, comprising:

estimating a foreground region relating to an imaged object;

estimating a background region relating to other than the imaged object; and

by using the image, the estimated foreground region and the estimated background region, calculating a transition region disposed between the foreground region and the background region;

wherein the estimated foreground region, the estimated background region, and the calculated transition region, each comprise a separate set of pixels that may each be processed separately for suppressing pixel intensities in the estimated background region and improving image quality;

wherein the calculating a transition region further includes iteratively calculating incremental transition regions, each having an incrementally larger gradient tolerance value, until a gradient tolerance value threshold is met or exceeded;

wherein each incremental transition region is calculated to be that region containing pixels connected to a pixel of a previously calculated incremental transition region, having an intensity greater than the second threshold, and having a gradient magnitude that is within the incrementally larger gradient tolerance value of the gradient magnitude of the incremental transition region pixel to which it is connected.

19. (previously presented) The program storage medium of Claim 18, wherein:

the estimating a foreground region comprises defining an initial foreground region as that region containing those pixels of the image meeting a first criterion; and

the estimating a background region comprises defining the background region as that region containing those pixels of the image meeting a second criterion; and,

the transition region is calculated by a gradient constrained hysteresis threshold method.

20. (previously presented) The program storage medium of Claim 19, wherein the first criterion comprises a pixel intensity greater than a first threshold.

21. (previously presented) The program storage medium of Claim 19, wherein the second criterion comprises a pixel intensity less than a second threshold.

22. (previously presented) The program storage medium of Claim 21, wherein the calculating a transition region comprises calculating the transition region as that region containing those pixels of the image meeting a third criterion.

23. (previously presented) The program storage medium of Claim 22, wherein the third criterion comprises:

a pixel having a pixel intensity greater than the second threshold, a morphological connection to a foreground pixel, and a gradient magnitude that is within a gradient tolerance value of the gradient magnitude of the foreground pixel.

24. (previously presented) The program storage medium of Claim 23, further comprising instructions for execution by the processing circuit for:

defining an object region as the union of the initial foreground region and the initial transition region, and performing at least one morphological operation on the object region.

25. (previously presented) The program storage medium of Claim 24, further comprising instructions for execution by the processing circuit for:

defining a final foreground mask as the initial foreground region;

defining a final transition mask as the difference between the object region and the final foreground region; and

defining a final background mask as the remainder of the image.

26. (previously presented) The program storage medium of Claim 25, further comprising instructions for execution by the processing circuit for:

suppressing pixel intensities in the background region by gradually reducing the intensity of background pixels to zero as a function of their distance from the object region.

27. (previously presented) The program storage medium of Claim 26, wherein the function comprises a linear ramp function, an exponential function, a Gaussian function, a Hanning function, a Hamming function, any function for reducing a value with respect to distance, or any combination of functions comprising at least one of the foregoing functions.

28. (cancelled)

29. (previously presented) The program storage medium of Claim 23, wherein the calculating a transition region further comprises:

using a focus parameter to merge a defined number of the initial plus incremental transition regions into a single transition region.

30. (previously presented) The program storage medium of Claim 18, wherein the digital image is a digital image of a biological object obtained using MR imaging, CT imaging, Ultrasound imaging, X-ray imaging, or any combination comprising at least one of the foregoing imaging processes.

31. (currently amended) A method for processing a digital image, the method comprising:

acquiring a digital first image of a biological object;

estimating a foreground region from the first image relating to ~~an imaged~~ the biological object as a region containing those pixels of the first image that have an intensity greater than a first threshold;

estimating a background region from the first image relating to other than the ~~imaged~~ biological object as a region containing those pixels of the first image that have and intensity less than a second threshold;

by using the first image, the estimated foreground region and the estimated background region, calculating an initial transition region by a gradient constrained hysteresis threshold method, said initial transition region being disposed between the foreground region and the background region; [[and,]]

defining a plurality of incremental transition regions from the initial transition region, wherein each of the plurality of incremental transition regions each have an incrementally larger gradient tolerance value;

wherein the estimated foreground region, the estimated background region, and the calculated transition region, each comprise a separate set of pixels that may each be processed separately and independently of each other for suppressing pixel intensities in the estimated background region and improving image quality to generate a second image of the biological object.

32. (currently amended) The method of Claim 31, wherein:

the first threshold is a percentage of the mean intensity of the non-zero pixels in the first image.

33. (previously presented) The method of Claim 32 wherein:

the inputs to said gradient constrained hysteresis threshold method is a gradient magnitude image and said estimated foreground region.